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AND

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THE NEW PATENT LAW.

WITH the object of affording information to the public until the new rules under the Act are completed, the following notice is issued by direction of the Board of Trade:—

NOTICE.

1. Applications and all other documents will be required upon strong wide-ruled foolscap paper (written or printed on one side only), having a margin of two inches on the left-hand part thereof. The use of parchment will be discontinued. Copies of specifications will no longer be required.

2. The sizes of the drawings will remain unchanged, but they will be required upon drawing paper instead of on parchment. A copy of the drawings will be required upon thin Bristol board.

3. Forms of application (stamped) will be placed on sale at the chief post-offices in the United Kingdom.

4. The forms required for an application will be—(a), for provisional protection: Application form and form of provisional specification; (b), for complete protection: Application form and form of complete specification. Where a complete specification is not left in the first instance, it may be left at any time within nine months after application for provisional protection.

5. The fees will be £1 for each stamped form of application and £3 for each stamped form of complete specification. No fee will be charged for the form for professional specification.

6. Applications may be left at the Patent Office or sent by post. If sent by post they must be addressed to the Comptroller, Patent Office.

7. The "Declaration" in the application form must be made by the inventor or inventors. All other documents may be prepared and signed by agents.

NOTE.—"Applications" for letters patent made during the present year must be proceeded with in accordance with the existing laws and rules.

AUTOMATIC SAFETY APPLIANCES.

IT is a trite saying that in the knowledge of danger there is safety; but this, like many other old saws, is only partially true. The many discoveries and improvements which, during the last half century, have been made in science and the mechanical arts, while they have conduced to the comfort and conveniences of the world, have for the most part been fraught with dangerous and apparently unavoidable concomitants. Many accidents, it is true, might be avoided by unremitting watchfulness, but we have to take human nature and physical endurance as we find them, and it is only in automatic safeguards that in many cases reliance can be placed.

Automatic signals, switches, and self-acting gates at crossings are not in as frequent use on our railroads as they should be. These and many other safety devices fail to be adopted, either from some false notion of economy, or from a wrong system of reasoning that, where implicit confidence is placed in them, and they accidentally omit to perform the duty assigned them, the consequences are most serious or fatal. This may be true in a measure, because we have to do with perishable materials and imperfect workmanship, but it nevertheless is unsound argument. There is no necessity to rely exclusively upon self-acting devices against accident, but wherever the same can, they ought to be adopted as additional means of securing safety, and we think that the time is not far distant when they will be thus employed more generally than they now are. Notwithstanding the much that has already been proposed and done in this connection, inventors should not be discouraged because the harvest is not yet ripe. The field is a wide one, and by no means fully explored as yet.

Railroad accidents occur, at times, owing to the failure of the air brakes to act when called into requisition upon some particular occasion, but this does not condemn these devices; they are useful and great means of safety notwithstanding. So it is with automatic safety appliances generally. Additional devices for securing safety and sufficient manual or other force to work them should also be provided. No single safety expedient is reliable. Such devices should always be duplicated or alternatives be at command, and we think that, so far as automatic means are concerned, provision should invariably be made for making them part of the ordinary working plant, so that, although not acting with their full force excepting when needed, they will not rust or bind, but be kept in good working order; or, if this cannot be done, than they should be operated occasionally, at stated periods, to insure their efficiency.

Much attention is now being directed to automatic safety and contrivances in connection with that modern substitute for long flights of steps in our lofty buildings, the passenger elevator; and although much has been already done in this line, and many inventors may find their proposed expedients anticipated, there is still great room for improvement and a fortune to the discoverer of the best device for the purpose. In the same category should not only be included freight elevators, but the many kinds of hoisting machinery in use for different purposes. Take, for instance, the chain hook tackle or grapple employed in our stores and warehouses for receiving and delivering goods in casks and other like packages. How many men are crippled and lives lost by the slipping of the load from the hooks while being raised and lowered through hatchways from one story to another? This need not and ought not to be, as safety devices to catch and hold the load till the hooks could be readjusted might be easily devised. We know of one large warehouse in a neighbouring city where accidents from this neglect are of almost daily occurrence.

There are many instances, however, besides these, in which self-acting safety means might be advantageously adopted. We will only mention a few as they occur to us. Automatic fire alarms might be introduced into our dwellings and tenement houses, which either flame or an undue rise of temperature would operate, and so wake the sleeping inmates; this might either be done mechanically or by the breaking or closing of an electric circuit. Self-closing gas taps, too, in the sleeping apartments of our hotels, that is, taps which would close when the light is blown out or otherwise extinguished, and that would require a special manipulation to open them again, might save many a verdant country cousin, careless person, or inebriate from dying of asphyxia. Again, if pistols were made that, by the act of loading them, would expose, and keep exposed till firing them, a plain and unmistakable indicator of their loaded condition, we should read of fewer of those lamentable occurrences in which death results from the foolish practice of pointing at another, though only in jest, a weapon erroneously supposed not to be loaded; and the timid, too, would be less likely to carelessly handle a fire arm that pronounced itself ready to kill.

But why enumerate? The subject of automatic safety appliances is an extensive one, and well worth the attention of the ingeniously inclined, who would also have the comforting reflection that their efforts were being directed toward the saving of human life.—*Scientific American.*

A NEW SAFETY RAILWAY CARRIAGE.

EVERY step in the direction of securing greater immunity from accident to railway travellers is a step in the right direction. The prevention of accidents altogether is "a consummation devoutly to be wished," but rather beyond the power of human ingenuity; hence anything which tends to minimise the chances of accident or minimise the effect on life or limb which an accident may occasion is worthy of some consideration. This latter is the object of a new invention patented by Messrs. Bennett and Rosher, of Church-street, Chelsea, and described as "The Cylindrical Compartment Safety Railway Carriage." The patentees point out that the majority of the injuries resulting from a collision are caused by the breaking up and splintering of the wooden compartments, and to obviate this they propose that upon the ordinary travelling platform or bogie instead of the usual wooden carriage body, there should be placed three or more iron cylinders transversely, so mounted that in the event of a collision the forces acting on the outer cylinders shall cause the centre one in the series of three to rise and thus break the force of the sudden impact which, under the existing system, results in the telescoping or crushing up of the body of the carriage. Each cylinder forms a compartment and is

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fitted up internally in the ordinary way. By the adoption of this principle it is contended that, although the shock cannot be entirely obviated, the danger to the passenger in one of these cylindrical compartments is comparatively slight, and by reason of one or two such carriages at either end of the train receiving the full force of the collision the shock would be absorbed by their yielding and rising up under the action of the opposing forces and the ordinary carriages composing the rest of the train would be in no danger of telescoping or crushing up. It would be scarcely desirable to get up a railway accident for the purpose of testing the practical value of the invention, but from a theoretical point of view the inventors have something in their favour, as there can be no doubt that a carriage upon their plan placed at the end of a train would in case of a collision tend greatly to reduce the force of the shock and lessen the probability of damage to the other carriages in the train and consequent injury to the occupants. Whatever may be thought of the practical working of the plan it is at any rate worthy of the consideration of those great companies whose interest lies in securing the safety of a large section of the population—the travelling public.

WASP STINGS.

This being the season at which petty questions and grievances are most likely to be relieved or redressed by the publicity offered by the press, a considerable number of correspondents are expressing the burning interest they take in the treatment of "wasp stings." There can be no doubt that under certain conditions the sting of a wasp may prove very injurious, or even dangerous to life. We are unable to indorse the opinion that there is no danger unless there be fear. It is quite possible that the sting of any insect capable of generating a poison may be fatal without the intervention of panic. The nervous system is in some of its states exceedingly susceptible of sudden impressions, which, as it were, "staggers" the nerve centres by shock. The bites of small snakes probably act in this way, and the sting of a wasp may prove fatal in the same fashion. As to remedies, ammonia, is, of course, the obvious recourse; but almost anything "strong," in a popular sense, will generally suffice to decompose and destroy an organic poison if instantly applied. This is why the juice of an onion answers the purpose. Anything equally pungent would do as well.—*Lancet.*

Swiss Patent Law.—The *Daily News* reports that at the Swiss Congress recently summoned to discuss the subject of the Patent Law, resolutions were passed recommending the Government to adopt some measure for the protection of inventions. The meeting was animated, and the opposition considerable, especially from the manufacturers of cotton aniline dyes. The resolution was finally passed by 110 votes to 52. No opposition was offered to the introduction of a "Trade Marks" law.

Forthcoming Exhibitions.—According to the continental papers, there will be held next year, at Stockholm, a Scandinavian Industrial Exhibition. Preparations are also spoken of in Nuremberg, in connection with an exhibition of industrial art to be held there in 1885. In that year the new building of the Bavarian Industrial Museum will be completed, and the exhibition referred to will appropriately celebrate its opening. As at present intended, the exhibition will include works in copper, gold, silver, tin, and zinc, as well as the alloys of these metals, art bronzes, goldsmiths' and silversmiths' work, castings of zinc, &c. In the latter branch, special attention will be paid to imitations of bronze works and galvanoplastic processes. The mechanical and historical features of the various subjects will be appropriately illustrated.

ENSILAGE.

A good many persons have been making experiments on ensilage during the past year. But nearly all have tried it with a view to seeing whether green forage would keep sound in an air-tight and water-tight pit, duly weighted on the surface, in default of being absolutely closed. That it would keep under such conditions ought to have gone without asking.

What ensilage does is to (1) increase the nutritive powers of green forage; (2) to obviate waste: (3) to save time; (4) to increase the productive powers of the soil. It does the first, if in no other way, by making the forage more digestible; the second, by saving a deterioration by exposure to weather; the third, by putting the least possible time between cutting and storing; the fourth as a sequence of the third, by enabling the farmer to cut a double crop yearly, by giving him opportunity for enlarging his stock of cattle, and by enormously increasing the amount and value of manure.

I know from the correspondence which I have had (at one time nearly that of a department in a Government office), that the construction of silos is going on on the new plan practised in the United States, and sketched in my little book on the subject, in India and Australia as well as generally in Europe. A day or two ago I gave leave to a correspondent to translate my book on ensilage into Swedish.

Most English silos of which I have read are made in too shallow masonry. It stands to reason that this increases the expense per cubic yard. They should be from 20 to 25 feet deep, if they are to be made in the cheapest way. I believe that my friend Mr. Samuel Whitbread has made the best hitherto constructed in England.

The main object of ensilage is to get two crops a-year off the same land. Silos are profitable if they obviate loss; most gainful when they increase produce. I should add, however, that cattle need cleanliness and ventilation as much as human beings do, and I do not wonder at disease being prevalent in English herds, and for the matter of that in flocks, when I see the dark, filthy dens in which they are exposed to weather. Our forefathers kept their sheep under cover from November to April.

Had silos been common in England, millions of pounds worth of fodder would have been saved last summer, and not much less worth of aftermath would be saved now. I should have thought that this was the time in which English agriculture could not afford to neglect small economies, let alone great ones.—Prof. Thorold Rogers, in the *Times*.

FOG-SIGNALLING AT SEA.

About this time of year the subject of fog-signalling is generally brought to the fore by the occurrence of some dire collision at sea The catastrophe affords the text for many wise discourses; and suggestions, all too late, are offered by the score. We shall reverse the process, and give the discourse before the special occasion for it has arisen, because the real occasion is ever present. It may very much surprise some people to learn that in the course of one year, 1881 for instance, the vessels lost at sea average one every four hours, most of these accidents occuring in fogs, or being directly due to darkness. In the North Atlantic alone, there were no fewer than four hundred ocean steamer collisions in the two years 1879 and 1880, all of which it is said, might easily have been avoided had the master of either of the colliding vessels known what course was being steered by the other. Statistics show an average loss of one steamer a day due to our imperfect system of fog-signalling! And if we consider that at certain seasons of the year the North Atlantic is never entirely free from fog, and think of the hundreds of vessels that are constantly threading their way along the more frequented routes, the wonder almost is that so many of them escape mishap. The question, then, of how to render fog-signalling more efficient than it is at present is plainly one of extreme urgency. Before noticing the suggestions that have been made with a view to improving matters, let us endeavour to appreciate the perilous and utterly helpless position of the befogged mariner under the existing arrangements. In the first place, when the blast of a fog-horn is heard, it shows that a steamer is somewhere near, but it is often quite impossible to tell from whence the sound comes. Fog is as blinding to the ears, so to speak, as it is to the eyes. It seems to destroy the ear's wonderful power of determining *direction* in sound. Now the fog-signal comes booming from one quarter; again it comes from another; and sometimes it seems to come from all round. The cause of this is supposed to be the varying density of the fog-bank in different parts, the dense regions reflecting the sound backwards and forwards just as clouds echo and re-echo the electric clap until it assumes the prolonged roll of thunder. The obvious consequence is that it becomes a physical impossibility for the master to make any use whatever of the knowledge that another steamer is in his immediate vicinity. Then secondly, supposing it possible to make out from what quarter a signal is sounding, nothing can be done unless it is known what course the neighbouring vessel is pursuing. It may be approaching, or it may be receding; it may be making straight for a collision, or it may be steering clear past. This, it will be seen, is an even more perplexing difficulty than the other. Two vessels may perfectly well happen to steer for the same point, and deliberately rush into one another, yet blowing their horns as lustily as possible all the time. For one or both to come to a standstill is out of the question. As we have already said, some regions of the Atlantic are seldom free from fog, and for vessels to stop every time they come within hearing distance of each other would soon reduce the Transatlantic traffic to a state bordering on stagnation. Obviously, the only thing to be done is to find some system of signalling which will overcome these two great difficulties, and give the mariner a clue which will enable him at least to do *something* towards averting a threatened danger. There is not much ahvantage in knowing that a danger menaces when it is not in one's power to take any precautions against it.

One way of really signalling (blowing occasional blasts, as is now done, is not signalling) with the fog-horn is to make it spell out the ship's course in the dot and dash alphabet. Any one of the 64 half-points of the compass can thus be indicated by seven or eight long and short blasts. The serious objection to this method is, that all the blasts being on the same note, the fog-bank echoes before alluded to would be very apt to reduce the signal to confusion. Another suggestion is that steamers should carry several whistles sounding different notes, and indicate their course by means of a special code of signals. This method is not open to the objection just mentioned, but, while feasible enough, would hardly work in practice, for the very good reason that it is too elaborate. We have just noticed a new system, devised by a practical man, and briefly described in the last number of the *Nautical Magazine*, which, as only two whistles and four different signals are used, has the recommendation of workableness. Whatever system be considered best in theory, something should be *done*. We have attempted to show that the human life and valuable property that is annually sacrificed through defective fog-signalling arrangements is simply appalling, and the inaction of those with whom it rests to take the lead in the matter is neither more nor less than culpable. To avert collisions at sea is impossible; but to render them less frequent is not; and the destruction of six vessels and many lives every day in the year is surely a disgrace to our civilization. —*The Science Monthly*.

THE SIREN FOG HORN.

The Zuyder Zee was recently the scene of some interesting experiments with Professor Holmes' siren fog horn. Two steam vessels, the one the Zwalaw, belonging to the Netherland Royal Steamship Company, the other the Hollandia, were each fitted with one of the fog horns, which, though well known in our navy, have up to the present time been used by the Dutch Government as lighthouse fog signals only. The object of the experiments was to ascertain if a small apparatus operated by steam could be used advantageously at sea for signalling on the Morse system of dot and dash. The two vessels left Rotterdam at 10 a.m., and, after passing through the sluice gates, and entering the Zuyder Zee, the smaller of the two ships ceased steaming, while the larger one put out to sea.

Telegraph clerks were employed to manipulate the apparatus, and although the distance eventually became so great that each vessel was invisible to those on board the other, yet the signals reached the ear distinctly, and were at once read off and understood. The usual and unexpected sounds caused the captain of an outward bound steamer, the William III., to suppose the Zwalaw was in distress, and to hasten to assistance. Upon getting alongside and ascertaining the true cause of the noises, he made no secret of his disgust and steamed away at full speed. After experimenting for about five hours, at distances varying from one to five miles, the signal "Come to us," was given from the Zwalaw, to which the Hollandia replied "We come," and was soon seen steaming toward her consort. There were present Mr. Reeringh, of the Marine Department; Colonel Steppens, Director of the Navy Yard; and the representatives of the various steamship companies. The results of the trials were considered to be in every way satisfactory, and to demonstrate the possibility of one vessel communicating intelligence to the other at sea although separated by a considerable distance. The experiments were conducted by Messrs. De Wit, engineers of Amsterdam, and Mr. C. Ingrey, C.E., the engineer of the Caloric Engine and Siren Company, of London.

An Experiment in Physics.—If in a given acidified and nearly saturated solution of a salt (I have generally used ferrous sulphate and added a small quantity of sulphuric acid) a piece of zinc is placed, and this solution carefully overlaid with common water, the bubbles of hydrogen appear to meet with considerable resistance at the zone of contact between the two liquids, and from one-third to one-half are reflected downward and to one side. Finally, however, they are again induced by their relative levity to rise: and now scattered, and at a part of the vessel remote from their first ascent, pass through the upper zone and escape into the air. This phenomenon is again exhibited if upon the second or upper stratum a third liquid is superimposed having a density less than water. The appearances at this second zone are, however, not quite as marked as at the first. What is the cause of this apparent reflection of the hydrogen bubbles in passing from a denser into a rarer medium? Mr. C. G. Wheeler, who describes this experiment in the *American Chemical Journal*, promises a further investigation. In the meantime it is perhaps worth repeating under varied conditions.

LABOUR SAVING CRANES.

At a recent meeting of the American Society of Civil Engineers, in New York, a paper by Mr. C. J. Appleby, on the subject of cranes as labour saving machines, was read by the author, who remarked that a well constructed crane or other similar power machine requiring only one man to drive it would do as much work as could be done by the manual power of ten men, but in one-tenth of the time they would require, It seems singular that railroad and waterside depots and workshops should so rarely be laid out with reference to the employment of such labour saving machines. The most economical working result is obtained from machines so arranged that when they take hold of the load, it is not released until final deposit. The author considered the following systems for transmitting or applying power:

1. The well known hydraulic system, with pressure pumps, accumulator, and distributing pipes.
2. Compressed air distributed through pipes.
3. Steam distributed as above.
4. High speed rope or "endless cotton cord," which runs at a speed of 5,000 to 6,000 feet per minute.
5. Low speed rope running 1,500 to 2,000 feet per minute.
6. Square shaft supported on tumbler bearings.
7. Steam from a boiler delivered on the top of a piston with multiplying chains similar to the hydraulic system.
8. Boiler and engine fixed on the crane, and driving gear for the several motions required.

The first, second, and third can only be applied to cranes fixed or moving over very limited areas. The fourth, fifth, and sixth will transmit power over large areas, which, however, should be nearly rectangular. The other two can be used generally where-ever there is a railway track. The hydraulic system possesses great advantages over compressed air or steam, but experience tends to the conclusion that its common use will be attended with considerable inconvenience where the winters are cold. The use of compressed air has not been applied with great success in many cases.

Steam is largely used, and frequently carried through 1,000 feet of pipe without much inconvenience. The high speed cotton cord runs at a speed of 5,000 to 6,000 feet per minute. The cork works in grooved pulleys, is carried on rollers or other supports at intervals of ten to twenty-five feet, and is kept in tension by a weighted pulley. Low speed rope transmission is generally effected by a hemp rope running from 1,600 to 2,000 feet per minute. The square shaft has been used for many years, the only special difficulty experienced being that of supporting the long main line of driving shaft. The author exhibited recent designs whereby this difficuly has been very successfully overcome. The relative advantage of rope or shaft transmission is largely influenced by local circumstances. As a general rule the rope system costs less and is better where the distance for transmitting exceeds 200 feet. Below that distance the shaft is probably the best and cheapest. But the rope possesses advantages when machinery has to be on different levels, or at an angle with the point from which the power is transmitted.

The steam crane, employed under many differing conditions perhaps performs more functions than any other mechanical arrangement for lifting and placing loads. All such cranes should lift and turn around by steam power. One, specially illustrated, has additional motions for altering the radius of the jib for hauling materials, so as to bring them within the reach of the machine, and also for moving empty or loaded cars. Fixed cranes are often seen so placed that one-third or even one-half of the number erected at a particular point are idle. It would, therefore, seem that for the same outlay, the best duty will be obtained from movable cranes. Where two or more railroad tracks are parallel with the water front, it will often be desirable to make the crane span the two lines of tracks, allowing head room for the vehicles to pass under it. Cranes fixed on floating vessels were also illustrated up to 60 tons power. Locomotive cranes up to 25 tons were described, and also cranes specially adapted to terminal freight stations. One of these has lifted 80 tons per hour a height of 20 to 30 feet, and deposited the loads of 1½ to 2 tons each 60 feet from the point where taken up. A similar crane commonly delivers 240 barrels of oil per hour the same height of lift and length of deposit.

The cost, per day, is one driver's wages and the necessary fuel, oil, &c. Five per cent. per annum is ample allowance for depreciation. The cost of this system of working is easily ascertained, but a great gain also arises from the increased speed of passing large quantities of merchandise.

The paper was discussed by Messrs. Cartwright, Cooper, Emery, Farney, Geo. S. Greene, Jr., Hamilton, R. L. Harris, James Platt, and the author.

LOCAL SCIENTIFIC SOCIETIES.

The rapid increase in the number of people who take a mild sort of interest in science has resulted in the foundation of innumerable "Philosophical Societies" and "Field Clubs" throughout the country, many of which annually blossom into printed *Transactions*; and the alarming addition to our scientific literature which this obviously implies is the cause of much groaning on the part of professional workers. The contents of these *Transactions* is an unknown quantity —often very much unknown. There may be one paper of sterling value on the local flora; a second may deal, perhaps, with a problem of wide interest in a really original way; and a third may be devoted to a remarkable and unexpected occultation of several fixed stars by (as subsequent inquiry discloses) a fly on the green observer's object-glass. Yet the earnest worker feels bound to look through all such collections, in case, by failing to do so, he should miss something of real importance. The task is not by any means insignificant, and it is an excessively irksome one to busy men. We need not be surprised, therefore, that they loudly complain, for in a certain measure their complaint is just. But what is to be done? Amateur dabblers would cry out—andwith reason—if they were to be denied the right to speculate upon the mysteries of the cosmos merely because their speculations sometimes happened to be nearer the truth than those of their professional brethren. And still more would they complain if they were to be allowed to observe and speculate and publish away as much as they chose, and have the results of their labour calmly ignored by those who condense and crystallize our knowledge for us. The suggestion of *Nature*, then, seems well suited to the case; namely, that in the matter of publication all local societies should confine themselves to local investigations, for which they are especially qualified, leaving the larger questions to be dealt with by the societies in London. This does not preclude aspiring members of the smaller societies from soaring as high as they like; only if their soarings are to any purpose they have the honour of appearing in the London *Transactions* instead of in those of their own bodies. And further, it leaves the parent societies free to devote all their attention to the broad questions connected with their respective branches of knowledge, instead of pottering over local details. Of course there are difficulties. Of course there would heart-burnings, and envy, and ill-feeling when little Sniggs, of the Kennington Oval Field Club, got his paper on the Geographical Distribution of the Boulder Clay into *the* journal. Of course the eminent Sir John Smith would feel just a little vexation (deny it how he might) on finding his invaluable memoir on Devonshire apples relegated to the Morebath *Transactions*. But some plan of the kind is worth trying. The time, labour, and bother generally that would be saved through all the provincial organisations co-operating with the metropolitan ones, and arranging their material for publication on a systematic plan, is simply incalculable, and would enable scientific men to well-nigh double the duration of their working lives.—*The Science Monthly*.

STEREOSCOPIC PORTRAITS BY A SINGLE CAMERA.

We have just taken, by means of a single 4 × 5 camera, some stereoscopic portraits of so excellent a quality and by means so simple as cannot fail to interest our readers and cause many of them to do likewise after they read our description.

Every one is, of course, aware of the existence and nature of an office chair, the seat of which rotates upon a central axis—usually a screw—of the same nature as that of a piano stool. Now if a sitter be posed in a chair of this nature, it stands to reason that when a camera is placed at a distance of a few feet away, the mere act of rotating the chair upon its pivot, and with it the sitter, will cause the latter to be presented to the lens under circumstances of horizontal displacement extending to 300 degrees, or equal to the entire circle.

Having posed the sitter according to taste, and being provided with a double dark slide containing two plates, the first exposure is made and the sitter enjoined to remain perfectly still while the chair is rotated to an *exceedingly slight extent*—an extent, indeed, that shall not be more than is barely appreciable—and another exposure made on the second plate. When developed and printed from, these negatives will yield proofs which shall be truly stereoscopic. Care must be taken that the rotation of the sitter be not carried to far, else will the effects obtained be vulgarised by the exaggeration of the relief. It is so very easy to produce this artificial relief, and the temptation to do so is so great, that the photographer must be on his guard against indulging in this trick, which, while calculated to startle the spectator, is as "untrue in nature as in art."

It cannot, however, be denied that some exceedingly funny and grotesque effects can be obtained by indulging in an excess of this movement of the sitter in azimuth. We have witnessed immoderate laughter being elicited when the portrait of a person whose nose was naturally rather large was presented for examination in the stereoscope, which showed it to project at least three or four inches in advance of his face. This effect was produced by bringing the camera within five feet of the sitter, and causing the chair to be rotated two or three degrees more than it ought to have been. In like manner may an individual whose face is rather thin be presented as decidedly hatchet faced, while the likeness otherwise remains so good as to cause recognition.

While experimenting in this direction, the photographer will not fail to notice what striking and novel effects can be obtained when a back view, either wholly or partially, of the sitter is focused upon the ground glass. If any readers who adopt the practice of photographic portraiture as *dilettanti* rather than as professionals will occassionally defiate from the regular habit of photographing their friends full or three-quarter face, and try instead, say, a full or three-quarter *back* view, it will afford an agreeable modification in the routine of their practice.

The method which we have just described of rotating the sitter in relation to single lens camera, is one equally sound in principle as easy in practice for producing true stereoscopic effect in portraiture. But it must be noted that the stereoscopic effect is confined to the sitter only, and has no relation to him (or her) and the background. For this reason the practice of stereoscopic portraiture by the means described should be confined to busts, and the backgrounds should be quite plain.—*Photo. Times*.

NON-POISONOUS WHITE LEAD.

Many attempts have been made to substitute for carbonate of lead—the ordinary poisonous white lead, that slowly but surely induces paralysis in those who come in contact with it for any considerable period—some less deleterious pigment. Zinc white has often been put forward as a substitute, and is indeed largely employed; but it is open to the objection of not possessing sufficient body or opacity. Sulphate of lead is not poisonous; but, when prepared in the ordinary way by precipitation, is of a crystalline nature, and, therefore, wanting in both these qualities.

A sulphate of lead has, however, been produced by Mr. John T. Lewis, of Philadelphia, by sublimation, which, when treated by the Freeman process, is stated to possess a body and colour superior to the best white lead made by the ordinary process, with the additional merit of being cheaper, while it is also non-poisonous.

In the smelting of lead ore into pig lead, 15 per cent. goes off in fumes, and 10 per cent. are all that it has hitherto been found possible to recover; by this process, however, the whole 15 per cent. are recovered. The sulphate may also be produced from a low quality of galena, or lead ore, which is not suited for smelting into metallic lead, and from the slag formed in the process of smelting.

The plant consists of simple subliming furnaces, iron cooling pipes, suction fans, and a series of flannel or calico bags, arranged vertically in a building well ventilated, so as to allow the filtered gases to escape, leaving behind the sublimed white lead, which is then merely shaken down from the bags into barrels placed beneath them. The manufacture is carried on at Joplin, Missouri, with four subliming furnaces, about 500 feet of cooling pipes and towers, with suction fans, which drive the fumes into 300 bags, 20 inches in diameter, and 38 feet long, arranged vertically. About 50 tons weekly of white lead are now being produced from waste fumes, slag, and poor ore, by this establishment alone, at a cost not exceeding that given in the following figures:—

20 cwts. of galena (with 82 per cent of ore)	£8	0	0
Cost of subliming and catching, including repairs, labour, and all expenses	1	10	0
Casks	0	6	0
	£9	16	0

Freeman's process consists of grinding together, in a dry state, under great pressure, and consequently with great friction, sulphate of lead and sulphate of zinc. While neither of these two substances alone possess good body or opacity, when treated by this process they are so changed in character, that the new substance is stated to be superior in these respects to the best form of ordinary white lead.

The white lead thus obtained mixes well with oil, and has also the advantage of not becoming blackened when exposed to the fumes of sulphuretted hydrogen, and of not peeling off in a saline atmosphere. As a basis for coloured paints, it is recommended on the ground that, being decomposed with greater difficulty, it can be mixed with almost any colouring substance; and, being free from acid, it does not change the tints of other substances.

General Mesny.—Major-General Mesny ought not to be altogether unknown to the English reader, for he was the companion of the late Captain Gill in his journey from the chief town of the province of Szechuen to Bhamo, on the Burmese frontier, and there is a great deal said about him in that lamented officer's excellent work "The River of Golden Sand." General Mesny is a native of Jersey, and consequently a subject of Her Majesty; but he has served the Chinese Government for so many years that he has become fully attached to his country, and is not to be distinguished from any other Chinese official. He entered their service before the Taeping rebellion was completely crushed, and he was sent on a special mission to Kweiyang, the chief town of the province of Kweichow. He had been there a good many years employed in keeping the Miavtze tribes in order, and also the high road to Yunnan open, when, in 1877 he promised to meet Captain Gill at Chentu, and to accompany him in his further journey towards the west. General Mesny has been in increasing favour with the Pekin authorities of late years, and at the time of the threatened complication with Russia in 1880 he was sent into Mongolia for the purpose of looking after the military arrangements in the Amoor region. He was recently ordered back to the south-west for the purpose of reporting on the state of affairs in Yunnan, partly on account of his former experience in that quarter of the Empire, and also on account of his knowledge of the French language. The following incident, taken from Captain Gill's work already referred to, will convey to our readers some idea of the kind of man this Chinese general is: but we must take leave to doubt the strict accuracy of the opinions put into his mouth by the *New York Herald's* correspondent as to the pre-eminent military efficiency of the Black Flags, and also as to the possibility of conquering China. Those opinions may or may not have a sound basis in fact; but the improbability of a foreigner so long in the Chinese service as General Mesny has been committing the indiscretion of giving expression to them will be obvious. To return to the incident we mentioned, Captain Gill and General Mesny had almost reached their journey's end, having passed the last station of the Chinese troops, and were riding through the debatable land held by the Kakhyen tribes between Yunnan and Burmah, when the latter being ahead, a man rushed out upon him with a drawn sword, thinking him to be alone and from his dress a Chinaman. The wild man shouted out that no one was to ride past. Seeing that the stranger was also armed, he ran back into his hut. He re-appeared with a gun, and, resting it on a tree, pointed it at Mesny. The latter, presenting his revolver, said, "If you shoot you are a dead man." The bully, finding he had mistaken his man, then cried out, "Oh, I am not shooting your way." "I do not care where you shoot: if you fire I shall hit you," retorted Mesny; and the wild man retired into his hut to wait for some other and more timid travellers to plunder or ill-use. We have described this incident in connexion with General Mesny for the benefit of those who cannot readily refer to "The River of Golden Sand," for themselves; but this mention of his name will serve the useful purpose of reminding us that the Chinese Government has several foreigners in its pay on whom it can depend in emergencies. —*Times*.

SMOKE ABATEMENT.

THE Council of the National Smoke Abatement Institution met recently at 44, Berners Street, to consider the resolution proposed at the Mansion House by the Duke of Northumberland, and seconded by Sir William Siemens:—

"That the period has now arrived at which systematic inquiry is desirable into the application of the resources of technical science for the abatement of smoke now largely produced in industrial processes and in the heating of houses, as well as into the operation of the existing laws for smoke abatement; and that the Council of the National Smoke Abatement Institution be requested to urge upon the Government the desirability of appointing a Royal Commission for the purpose."

It was decided to comply with the request contained in the resolution, and a Committee of the Council was appointed to take the necessary steps. A proposition to arrange with the Council of the Parkes Museum for space to exhibit smoke-abating appliances at that Institution was considered and adopted, subject to conditions being agreed. The following general report on the tests made by the Institution since the last meeting was presented, together with detailed statements and tables, prepared by the Engineer for further publication:—

TESTS.

Steam Boiler Furnaces.—Mallett's System of Controlled Combustion.—By this system the draught of air necessary to maintain combustion of the fuel is caused by a fan. The supply of air is heated and regulated as to quantity, and the heated gases are utilised on their passage to the chimney to heat the water which supplies the boiler. Tests of the evaporative efficiency of a boiler erected specially for the purpose at South Kensington, and worked under different conditions, were taken on several successive days by Mr. D. K. Clark, Testing Engineer to the Institution. The flue gases were analysed and their composition determined by Professor Chandler Roberts' method. The manipulative work being done under his direction by his assistant, Dr. E. J. Ball.

Brown and Green's Patent Furnace and Furnace Bars for Steam Boilers.—By this system the gaseous products of combustion are checked on their passage to the chimney by means of a "dependent" or "hanging" bridge, fixed to the upper part of the furnace above the fire grate, at a short distance from the ordinary fire-bridge.

The grate bars are sloped inwards, and, the gaseous products after being arrested in their onward course by the dependent bridge, are deflected downward upon the incandescent fuel, and smoke is abated to the extent of about four-fifths of that ordinarily produced.

Tests of the evaporative efficiency of a boiler erected at Luton, and of the smoke produced in the furnace of that boiler, with and without the patented system, were made on various days by Mr. D. K. Clark.

A new boiler of larger size and improved construction to that tested at South Kensington has been obtained to further test the Mallett system. Inquiry has been made through Sir Frederick Abel as to whether facilities for these further tests can be given at Woolwich Arsenal. If not, application will be made to the Admiralty for the necessary accommodation, it having been intimated on a former occasion that such application would be favourably entertained.

Furnaces for heating bakers' ovens by coal have been made. By the result of all these tests of coal-burning furnaces it is further demonstrated in a practical manner that smoke can be prevented with economy. Furnaces for heating bakers' ovens by gas have also been tested, and the results, which are of an important character, will be brought forward at an early meeting of the Master Bakers' Association.

Gas cooking and gas heating stoves have been tested on an extensive scale at the South Metropolitan Gas Works, by the testing engineer of the Institute, Mr. Kinnear Clark, under the superintendence of the Gas Jurors of the late Exhibition of Gas Apparatus at the Crystal Palace.

In connection with these tests, gas burners and regulators have been tested. The result of a very full series of tests of stoves is in preparation, showing the relative economy of heating and cooking by gas, as compared with coal.

The improvement in gas stoves and apparatus has been very marked, and the results of the later tests will show upwards of 20 per cent greater efficiency in gas stoves brought out since the Smoke Abatement Exhibition at South Kensington.

As appliances for the conservation of heat, as well as its production and application, come within the scope of the Institution tests, non-conducting compositions for coating boilers and steam pipes have been made, and an extended series of these tests, to compare different compositions, is now being carried on at Millwall by the Institution. The first tests of these compositions carried out by the Institution at Manchester last year showed a *maximum* economy obtained by the use of non-conducting coating of 58 per cent of the steam condensed in bare pipes. By the later tests of recently introduced compositions the economic efficiency has risen to upwards of 70 per cent.

ECONOMY OF FUEL IN HOUSE FIRES.

MR. T. FLETCHER, F.C.S., in an article in the *Journal of Science*, makes the following observations:—

The opinion previously expressed in this Journal, that open fires should be renounced in favour of stoves, is one not at all likely to be a general one where the cost of fuel is not excessive. Having for years in succession tested, in actual practice in my own house, nearly every possible system of heating,—by warm-air flues, hot water, close and open stoves heated by gas, coal, and coke, open fires of coke and coal, gas stoves and gas fires,—it will possibly be a matter of interest to some how the series of trials has terminated by the survival of the fittest.

The tests have been undertaken partly as a question of personal comfort and economy, and partly to obtain information for business purposes; and the latter reason has enabled me to carry out the experiments in a much more exhaustive and complete form than is likely to be done by any private individual for his own comfort.

Where a large body of air has to be heated in public rooms, plant-houses, and similar structures, there can be little doubt that hot-water pipes give the best result; and in my own experience the most satisfactory boiler is a simple coil of iron pipe, with the fire in the centre. Where equal and steady heating is required it is advisable to put in the circuit a large tank for hot water, into which all surplus heat is taken and stored. By this means, with the most irregular firing by careless and unskilled servants, the temperature of plant-houses and rooms which require to be kept aired can be controlled with perfect ease and little trouble; but to sit quietly and comfortably in rooms so heated is out of the question, apparently for the simple reason that the temperature of the floor and lower strata of air is always lower than that of the upper parts, the consequence being cold feet and a feeling of general discomfort.

My own sitting room—containing my private comfortable corner, special easy chair, and other matters which constitute my den, to which I retire for ease and absence of "bother"—has gone through a series of slow-combustion grates fired with coal, then with coke; grates with warm-air apparatus grates without warm-air apparatus, supplied with fresh air from the outside, and heated with coal and also with gas; incandescent gas-fires with supplementary warm-air apparatus to utilise the waste heat, and incandescent gas-fires utilising the radiant heat only. The round has been a pretty long one, and it has settled at the indisputable fact that radiant heat, and radiant heat alone, with the freest ventilation, is the only really comfortable and desirable way to heat a room used as a sitting-room and library.

This brings the question down to a choice of an ordinary open fire and an incandescent gas-fire, and the latter has been selected on account of the ease with which it is controlled, its instant readiness, and its total freedom from dirt. Although a complete year's work with this has not been gone through, it is evident that a room 15×20 feet can be comfortably and pleasantly heated with an incandescent gas-fire for about £6 per annum, with coal-gas at 3s. per 1,000 feet, all the warm air being sent up a freely open chimney, the cost being about three times that of a coal-fire, against which may be placed saving of labour and dirt.

In the passages and bed-rooms a purely radiant heat is an expensive luxury which is not by any means necessary, or even desirable; and here we may adopt two systems:—hot-water pipes for the passages, which for economy may be heated by gas, which have the special advantage of being under immediate control. Why a warm-air stove should be preferred in a bed-room appears to admit of a simple explanation *i.e.*, that the temperature of the lower strata of air and of the floor is a matter of little importance to persons in a recumbent position, the objection to this being only felt by those who are quietly sitting in a room with a low temperature.

I do not find that any person who has a choice between sitting in a room heated by purely radiant heat and one heated by warm air will, under any circumstances, choose the latter, even if the room itself is in other respects far more convenient and comfortable; and so long as a coal or incandescent gas-fire can be obtained at a reasonable cost, it does not appear at all likely that any stove will be adopted in ordinary sitting-rooms, whatever its apparent advantages may be.

INCOMBUSTIBLE PAPER AND COLOURS.

AT the Séance of the Société d'Encouragement pour l'Industrie Nationale on the 27th July of this year, M. G. Meyer, submitted to the examination of the Society the results of his new experiments with his combustible paper and colours. The admirable manner in which these materials could resist a high temperature was illustrated by rolls of the paper, printed with diverse colours: one half of the roll having been exposed for four hours to the heat of a muffle furnace. On a comparison of the two halves, that which had been subjected to the heat of the furnace had lost nothing of its flexibility, or the colours of their brilliancy.

The value of this invention of M. Meyer's has the advantage that the materials cost not much more than the paper, colours, ink, &c. generally employed, so that important documents, scenery for theatres, and wall-paper may be made, so as to resist a heat sufficient to melt glass, almost as cheaply as the articles now employed.

A sample of this paper with a printed design, which we have had the pleasure of examining, heated for a short time to redness in an air-gas burner, the design appeared almost as bright as before the operation, which but a slight alteration of the texture of the paper, and no loss of flexibility or toughness.—*Chemical News*.

The Scientific Review

AND

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SESSION 1882—1883.

If any meeting be held special notice *per post* will be supplied.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

Proceedings of the Institute.

The Institute being out of session no meetings have been held.

Monthly Notices.

Society of Arts.—The 130th Session of the Society of Arts will commence on the 21st inst., with an opening address from Sir William Siemens, the Chairman of the Society's Council. Previous to Christmas there will be four ordinary meetings, in addition to the opening meeting, and for these the following arrangements have been made:—November 28th, A. J. R. Trendell, "The International Fisheries Exhibition of 1883;" December 5th, Thomas T. Bruce Warren, "The Manufacture of Mineral Waters;" December 12th, Thomas Fletcher, F.C.S., "Coal-gas as a Labour-saving Agent in Mechanical Trades;" December 19th, W. H. Preece, F.R.S., "The Progress of Electric Lighting." There will be six courses of lectures delivered during the Session, under the bequest of Dr. Cantor. There will be 1st, "The Scientific Basis of Cookery," by W. Mattieu Williams, F.C.S.; 2nd, "Recent Improvements in Photo-Mechanical Printing Methods," by Thomas Bolas, F.C.S.; 3rd, "London Houses," by Robert W. Edis, F.S.A.; 4th, "The Alloys used for Coinage," by Professor W. Chandler Roberts, F.R.S., Chemist of the Royal Mint; 5th, "Some New Optical Instruments and Arrangements," by J. Norman Lockyer, F.R.S., F.R.A.S.; and 6th, "Fermentation and Distillation," by Professor W. Noel Hartley, F.C.S. The usual short course of Juvenile Lectures will be delivered during the Christmas holidays. The subject will be "Crystals and Crystallisation," and the lecturer Mr. J. M. Thomson, of King's College, London.

Liquid for Determining the Specific Gravity of Minerals.—Nearly all natural minerals are heavier than water, and therefore sink in it. But when they are placed in a heavy liquid which does not dissolve them, some sink and others float. If two minerals of unlike gravity occur in the same rock, they can be separated by pulverising the rock and putting them in a liquid intermediate in weight between both. A new liquid for this purpose has been devised by C. Rohrback, having a density of 3·57. It is an iodide of barium and mercury, and is prepared as follows:—100 parts of iodide of barium and about 130 parts of red iodide of mercury are mixed with about 200 c.c. of distilled water, shaken, and heated on an oil-bath to 150° or 200° C. until dissolved, and then concentrated until it will float a crystal of topaz. After standing several days the clear liquid is decanted and filtered. It has a yellow colour, boils at 145° C., and refracts light strongly. It can be used for separating axinite, kyanite, in part, epidite, heavy mica, some garnets, and nearly all hornblendes; also jade, olivine, orthite, nearly all members of the pyroxene group, saussurite, titanite, topaz, heavy tourmaline, vesuvianite, and basaltic rocks. In diluting it to obtain any special density, it is mixed with a dilute solution of the same, so as to avoid precipitation. After the separation the powdered minerals are washed with a few drops of iodide of potassium. —*Wiedermann's Annalen.*

Death of Mr. R. Werdermann.—On September 15, the well known electrical engineer, Mr. R. Werdermann died, at the comparatively early age of 55 years. The deceased gentleman had been resident in London since the year 1870, when he brought over from Paris and introduced into England the "Gramme" dynamo electric machine. Notwithstanding his long connection with the invention of M. Gramme, and the enthusiastic manner in which he championed this most successful machine of modern times, we understand that he sustained heavy loses in his business associations therewith. The recent decision of Judge Blatchford, in America declaring the Gramme patent void, was, we believe, a most serious and heavy blow to him, as we are informed that he owned the American patent. In 1878 Mr. Werdermann's name was most prominently brought forward in connection with his so-called *semi*-incandescent electric light. The records of the Patent Office show very forcibly his great energy in other directions. For the past two or three years he had busied himself in perfecting a new dynamo and an incandescent lamp. He was an eminently practical electrician, and his knowledge of many other branches of science was very considerable. Numberless experiments were made by him with dynamos of various construction, arc lamps and electric candles, electro-plating, the transmission of power by electricity, which is now attracting so much attention at home and abroad, electrical railways, and many other minor matters in which electricity played the leading part.

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NOVEMBER, 1883.

GOOD AND BAD WORK.

For a long time now we have seen with pain, that in a great many of our machine shops the quality of workmanship has been steadily deteriorating, presumably to meet the difficulties of competitive contracts now so universally adopted.

The same evil is, and has long been, rampant in nearly every other trade, thus rendering it a matter of no surprise that the ever growing desire for "cheapness" should eventually extend itself to the Engineering branches, although it is here more to be deplored, and less to be excused, possibly, than in any other form of handicraft.

Already we have advocates for "jerry" building in machines and engineering work, as we have had previously for brick and carpentry work; and where it is not openly advocated, it is often excused on the ground that close competition and hard bargaining compels the turning out of work which is passable, rather than excellent.

A business application for estimates for any projected piece of work, sent to half a dozen shops in the same or adjacent localities, where the facilities for workmen and transport are quite equal, shows that no two of them will furnish estimates at all comparable for the same job. Indeed, in some instances, the difference in the terms is quite surprising, when it is considered that the cost of materials and the methods of working them are nearly identical. As an instance, we have recently had under our notice a case, where a professional man had submitted plans and specifications for a projected piece of work, which he had estimated at about £750, and out of 5 estimates sent in, although the specifications entered into the minutest detail, the difference between the highest and lowest tender was nearly £150. Under these circumstances the only possible means of lowering the price is by slighting the work, which, however, is sure to be detected sooner or later, to the great and permanent injury of the firm's reputation, and the loss, as a consequence, of all the business which is worth having.

This is more particularly true of the manufacture of tools and machinery; for in both these cases, poor workmanship is absolutely certain to early reveal itself. It must also be borne in mind that when a tool gives way, or a machine breaks down, the owner is in no humour to excuse it on the ground that he "bought it cheap;" but he at once and for ever condemns the maker, just as heartily as if he had paid the best price in the market. He goes no more to the "cheap" manufacturer, neither does he recommend his productions; on the contrary, he is sure to run down the firm amongst all his personal acquaintances.

This vicious system of scamping work—happily not yet universal—is beginning seriously to tell against English work abroad, and if this country is to continue in the proud position of superiority it has hitherto held, with regard to the production of good machinery, something must be done at once, in the way of a complete return to the sound and honest work of the past.

The mechanic who puts really good work into his machines and tools, is making for himself a reputation which is cumulative in extent, and of far greater value than a reputation for low prices alone. As a matter of fact, a piece of work bears a direct relation to its cost of production, and therefore has no absolutely high or low price at all. That which seems high in price may be the cheaper of the two, and will in reality always be so, provided the correct relation between price and value be preserved. And further, it is questionable whether high prices repel as many would be customers as first-class workmanship attracts.

The truth of all this is best attested by the wonderful success of a firm we know, whose productions are familiar all over the world where machinery is in use. They have within the last 25 years grown from a small shop employing about three men and a boy, to a large establishment giving work to six or seven hundred men. Now from the very commencement this firm charged a high price, as compared with others in the same line, and yet steadily grew to their present dimensions, proving that good work will surely win its reward, although a high price has to be charged to ensure it.

No job is ever permitted to be scamped because some error has been made in an estimate or contract. We have here the only sound policy. It is far better to lose some money over a single piece of work, than to lose reputation for excellence.

This is in no way an isolated case, although given by way of illustration, as doubtless we have yet a goodly number of honourable firms in the engineering trades, who will not stoop to turn out inferior work; but who are always aiming at improvement in their particular line, and whose name is a guarantee of excellence, and a protection to the purchaser. Nevertheless the mischief being wrought by others, from motives of competitive economy, is none the less real and serious, and unless we are to be distanced at no remote date by our continental rivals, we must on all sides set our house in order, and once again devote ourselves, both masters and workmen alike, to the production of such work as we can take a pride in, and which will do us honour in the face of our rivals all over the world.

CHINA GRASS.

THE following article appeared in a recent number of the *Times* :—

The subject of the cultivation and commercial utilisation of the China grass plant, or rhea, has for many years occupied attention, the question being one of national importance, particularly as affecting India. Rhea, which is also known under the name of Ramie, is a textile plant which was indigenous to China and India. It is perennial, easy of cultivation, and produces a remarkably strong fibre. The problem of its cultivation has long been solved, for within certain limits rhea can be grown in any climate. India and the British colonies offer unusual facilities, and present vast and appropriate fields for that enterprise, while it can be, and is, grown in most European countries. All this has long been demonstrated; not so, however, the commercial utilisation of the fibre, which up to the present time would appear to be a problem only partially solved, although many earnest workers have been engaged in the attempted solution. There have been many difficulties in the way of decorticating the stems of this plant, and the India Government, in 1869, offered a reward of £5,000 for the best machine for separating the fibre from the stems and bark of rhea in its green or freshly cut state. The India Government was led to this step by the strong conviction, based upon ample evidence, that the only obstacle to the development of an extensive trade in this product was the want of suitable means for decorticating the plant. This was the third time within the present century that rhea had become the subject of official action on the part of the Government, the first effort for utilising the plant dating from 1803, when Dr. Roxburg started the question, and the second from 1840, when attention was again directed to it by Colonel Jenkins. The offer of £5,000 in 1869, led to only one machine being submitted for trial, although several competitors had entered their names. This machine was that of Mr. Greig, of Edinburgh, but after careful trial by General (then Lieutenant-Colonel) Hyde it was found that it did not fulfil the conditions laid down by the Government, and therefore the full prize of £5,000 was not awarded. In consideration, however, of the inventor having made a *bona fide* and meritorious attempt to solve the question, he was awarded a donation of £1,500. Other unsuccessful attempts were subsequently made, and eventually the offer of £5,000 was withdrawn by the Government.

But although the prize was withdrawn, invention did not cease, and the Government, in 1881, re-offered the prize of £5,000. Another competition took place, at which several machines were tried, but the trial, as before, proved barren of any practical results, and up to the present time no machine has been found capable of dealing successfully with this plant in the green state. The question of the preparation of the fibre, however, continued to be pursued in many directions. Nor is this to be wondered at when it is remembered that the strength of some rhea fibre from Assam experimented with in 1852 by Dr. Forbes Royle, as compared with St. Petersburg hemp, was in the ratio of 280 to 160, while the wild rhea from Assam was as high as 343. But, above and beyond this, rhea has the widest range of possible applications of any fibre, as shown by an exhaustive report on the preparation and use of rhea fibre by Dr. Forbes Watson, published in 1875, at which date Dr. Watson was the reporter on the products of India to the Secretary of State, at the India-office. Last year, however, witnessed the solution of the question of decortication in the green state in a satisfactory manner by M. A. Favier's process, as reported at the time. This process consists in subjecting the plant to the action of the steam for a period varying from 10 to 25 minutes, according to the length of time the plant had been cut. After steaming, the fibre and its adjuncts were easily stripped from the wood. The importance and value of this invention will be realised, when it is remembered that the plant is cultivated at long distances from the localities where the fibre is prepared for the market. The consequence is, that for every hundredweight of fibre, about a ton of woody material has to be transported. Nor is this the only evil, for the gummy matter in which the fibre is embedded becomes dried up during transport, and the separation of the fibre is thus rendered difficult, and even impossible, inasmuch as some of the fibre is left adhering to the wood. M. Favier's process greatly simplifies the commercial production of the fibre up to a certain point, for, at a very small cost, it gives the manufacturer the whole of the fibre in the plant treated. But it still stops short of what is required, in that it delivers the fibre in ribands, with its cementitious matter and outer skin attached. To remove this, various methods have been tried, but as far as we are aware, without general success—that is to say, the fibre cannot always be obtained of such a uniformly good quality as to constitute a commercially reliable article. Such was the position of the question when, about a year ago, the whole case was submitted to the distinguished French chemist, Professor Frémy, Member of the Institute of France, who is well-known for his researches into the nature of fibrous plants, and the question of their preparation for the market. Professor Frémy thoroughly investigated the matter from a chemical point of view, and at length brought it to a successful and, apparently, a practical issue.

One great bar to previous success would appear to have been the absence of exact knowledge as to the nature of the constituents of that portion of the plant which contains the fibre, or, in other words, the casing or bark surrounding the woody stem of the rhea. As determined by Professor Frémy, this consists of the cutose, or outer skin, within which is the vasculose containing the fibre or other conjoined matter, known as cellulose, between which and the woody stem is the pectose, or gum, which cause the skin or bark, as a whole, fibre included, to adhere to the wood. The Professor, therefore, proceeded to carefully investigate the nature of these various substances, and in the result he found that the vasculose and pectose were soluble in an alkali under certain conditions, and that the cellulose was insoluble. He therefore dissolves out the cutose, vasculose, and pectose by a very simple process, obtaining the fibre clean, and free from all extraneous adherent matter, ready for the spinner. In order, however, to insure as a result a perfectly uniform and marketable article, the Professor uses various chemicals at the several stages of the process. These, however, are not administered at haphazard, or by rule of thumb, as has been the case in some processes bearing in the same direction, and which have consequently failed, in the sense that they have not yet taken their places as commercial successes. The Professor, therefore, carefully examines the article which he has to treat, and, according to its nature and the character of its components, he determines the proportions of the various chemicals which he introduces at the several stages. All chance of failure thus appears to be eliminated, and the production of a fibre of uniform and reliable quality, removed from the region of doubt into that of certainty. The two processes of M. Favier and M. Frémy have, therefore, been conbined, and machinery has been put up in France on a scale sufficiently large to fairly approximate to practical working, and to demonstrate the practicability of the combined inventions. The experimental works are situated in the Route d'Orleans, Grand Montrouge, just outside Paris. Trials have been carried out by M. Albert Alroy, under the supervision of M. Urbain, who is Professor Frémy's chief assistant and co-patentee, and were attended by Dr. Forbes Watson, Mr. M. Collyer, Mr. C. J. Taylor, late member of the General Assembly, New Zealand, M. Barbe, M. Favier, M. G. Brogden, Mr. Caspar, and a number of other gentlemen representing those interested in the question at issue.

The process, as carried out, consists in first treating the rhea according to M. Favier's invention. The apparatus employed for this purpose is very simple and inexpensive, consisting merely of a stout deal trough or box, about 8ft. long, 2ft. wide, and 1ft. 8in. deep. The box has a hinged lid and a false open bottom, under which steam is admitted by a perforated pipe, there being an outlet for the condensed water, at one end of the box. Into this box the bundles of rhea were placed, the lid closed, steam turned on, and in about twenty minutes it was invariably found that the bark had been sufficiently softened to allow of its being readily and rapidly stripped off by hand, together with the whole of the fibre, in what may be called ribands. Thus the process of decortication is effectively accomplished in a few minutes, instead of requiring, as it sometimes does in the retting process, days, and even weeks, and being at the best attended with uncertainty as to results, as is also the case when decortication is effected with machinery. Moreover, the retting process, which is simply steeping the cut plants in water, is a delicate operation, requiring constant watching, to say nothing of its serious inconvenience from a sanitary point of view, on account of the pestilential emanations from the retteries. Decortication by steam having been effected, the work of M. Favier ceases, and the process is carried forward by M. Frémy. The ribands have been produced, the fibre in them has to be freed from the mucilaginous secretions. To this end, after examination in the laboratory, they are laid on metal trays, which are placed one above the other in a vertical perforated metal cylinder. When charged, this cylinder is placed within a strong iron cylinder, containing a known quantity of water, to which an alkali is added in certain proportions. Within the cylinder is a steam coil for heating the water, and, steam having been turned on, the temperature is raised to a certain point, when the cylinder is closed and made steam-tight. The process of boiling is continued under pressure, until the temperature—and consequently the steam pressure—within the cylinder has attained a high degree. On the completion of this part of the process, which occupies about four hours, and upon which the success of the whole mainly depends, the cementitious matter surrounding the fibre is found to have been transformed into a substance easily dissolved. The fibrous mass is then removed to a centrifugal machine, in which it is quickly deprived of its surplus alkaline moisture, and it is then placed in a weak solution of hydrochloric acid for a short time. It is then transferred to a bath of pure cold water, in which it remains for about an hour, and it is subsequently placed for a short time in a weak acid bath, after which it is again washed in cold water, and dried for the market. Such are the processes by which China grass may become a source of profit alike to the cultivator and the spinner. A factory situate at Douviers has been acquired, where there is machinery already erected for preparing the fibre according to the processes we have described, at the rate of one ton per day. There is also machinery for spinning the fibre into yarns. These works were also visited by those gentlemen who were at the experimental works at Montrouge, and who also visited the Government laboratory in Paris, of which Professor Frémy is chief and M. Urbain *sous chef*, and where those gentlemen explained the details of their process and made their visitors familiar with the progressive steps of their investigations.

With regard to the rhea treated at Montrouge, we may observe that it was grown at La Reolle, near Bordeaux. Some special experiments were also carried out by Dr. Forbes Watson with some rhea grown by the Duke of Wellington at Strathfield-saye, his grace having taken an active interest in the question for some years past. In all cases the rhea was used green and comparativety freshly cut. One of the objects of Dr. Watson's experiments was, by treating rhea cut at certain stages of growth, to ascertain at which stage the plant yields the best fibre, and consequently how many crops can be raised in the year with the best advantage. This question has often presented itself as one of the points to be determined, and advantage has been taken of the present opportunity with a view to the solution of the operation. Mr. C. J. Taylor also took with him a sample of New Zealand flax, which was successfully treated by the process. On the whole, the conclusion is that the results of the combined processes, so far as they have gone, are eminently satisfactory, and justify the expectation that a large enterprise in the cultivation and utilisation of China grass is on the eve of being opened up, not only in India and our colonies, but possibly also much nearer home.

PHOTOGRAPHY BY THE ELECTRIC LIGHT.—Mr. A. J. Jarman has succeeded in printing photographs from ordinary negatives upon sensitized albumenized paper by the light of the electric arc. Sixty photographs of various sizes may be printed at once by the light of one lamp. The method promises to be of great advantage in the wholesale production of photographs, rendering their preparation altogether independent of that (in this climate) uncertain factor, sunlight.

COTTON INDUSTRIES OF SWITZERLAND.—Consul Mason, of Basle, states that there are in Switzerland, according to the most recent statistics, 140 cotton mills, which have an aggregate of 1,854,091 spindles. This is an average of 675 spindles to every 1,000 of the entire population of the country. These mills consume yearly from 100,000 to 120,000 bales of cotton, of which about 3-5ths, or from 60,000 to 80,000 bales, come from the cotton fields of the United States. The cotton manufacture of Switzerland is confined mainly to the north-east cantons, and the oldest cotton mill in Switzerland is at Neue Welt, near Basle, and was established in 1823. The gradual but steady growth of this branch of manufacture will be shown by the importation of raw cotton, which, in 1857, amounted to 22,253,000 lbs., had increased, in 1882, to 51,355,480 lbs. The manufacture of embroideries employs more than 50,000 persons, who produce, annually, goods estimated at a value exceeding £2,500,000: and who receive 1,880,000 in wages. The cotton spinning industry employs 15,000 operatives, who earn about 420,000 annually. Cotton weaving, dyeing, and printing give employment to 17,000 working people, whose aggregate annual earnings are estimated at £382,000. Cotton is also largely used in combination with silk in the manufacture of ribbons by the great ribbon weavers in the district of Basle, who, with a silk warp and a cotton woof, produce not only plain *moire* satin, but also figured ribbons of great beauty and durability. So perfect is this process of weaving, that the cotton is perfectly concealed, and the warp so thoroughly kept on the outside, that the ribbon appears to be wholly made of silk. The raw cotton consumed in Switzerland is purchased at Liverpool, Havre, and Bremen, or imported direct from the United States through the ports of Havre, Rotterdam, Antwerp, and Genoa.

MANUFACTURE OF STEEL RAILS.

DURING the recent meeting of the Steel Institute the members paid a visit to the steel works of Messrs. Bolckow, Vaughan, & Co., at Eston—or the Cleveland Steel Works, as they are called. They adjoin the blast furnaces of the firm at Eston and South Bank, the latter range of furnaces being merely separated from the former by the Middlesbrough and Saltburn branch of the NorthEastern Railway, which passes between them, and is connected with the sidings of both the works. The works are also connected by a private line with a fine jetty on the banks of the Tees, provided with ample appliances for the rapid unloading of foreign ore, &c., and for the shipment of rails.

There are now at the Cleveland Steel Works six converters, each of 15 tons capacity, devoted to the basic process. These converters are disposed in two groups of three each, the whole six converters being in one straight line, and each group having in front of it a shallow double pit in shape somewhat like the letter ω, and provided with two hydraulic ladle cranes. The section of the building containing the converters and pits is spanned by steam travelling cranes by which converter bottoms, &c., can be lifted, and by which the charges of lime are brought to the converters in suitable iron hoppers. At the back of the converters and at a convenient height runs a charging stage, along which are conveyed to the converters in ladles mounted on carriages the charges of molten iron from the blast furnaces, and from which the converters also receive the additions of hematite and spiegel. The staging is provided with the necessary hoists, and behind it again is a space devoted to the preparation of the converter bottoms, hoods, &c., the plant in this department including mortar mills for the mixing of the magnesian limestone with tar, large ovens for the firing of the bottoms, &c. The bottoms, we may mention, are rammed by hand, the men using redhot bars for rammers, and the tuyere holes for the blast being formed by iron cores inserted in the mould. The material is well rammed around these cores, and the latter are as a rule knocked out before the bottoms are fired.

Returning to the front of the converters, it will be readily understood that by the arrangement of ladle cranes above mentioned, either crane can command two converters. The processes of pouring from the converter to the ladle, and the subsequent teeming of the steel into the moulds, are the same as in the ordinary Bessemer process, but the quantity of slag to be dealt with is much greater—being about one-third the weight of the steel—and it is the practice to pour off a great portion of this slag from the converter immediately after the "after blow," as it is called (this being the name given to the part of the blowing which lasts after the elimination of the carbon), and prior to the addition of the spiegel.

The rail ingots cast are 15½ inches square, and vary in weight from 1¼ to 1½ tons, according to the section of rail to be rolled, As soon as possible after teeming they are taken from the moulds, placed on trolleys, and run off by small locomotives, running on lines of 3 foot gauge to the range of gas furnaces, where they are wash-heated, or rather where their heat becomes equalised throughout, the amount of real heating done in these furnaces being comparatively small, and there being, it must be borne in mind, no subsequent heating whatever.

After having remained a sufficient time in these furnaces the ingots are drawn out by a very simple arrangement of hydraulic gear, each ingot as drawn being received by a trolley which is at once towed off by one of the small locomotives to the cogging mill. The cogging mill is a reversing mill with 48 inch mills rolls, and here in the course of eleven passes the ingot is rolled down from 15½ inches square to a bloom 8 inches square. The cogging rolls have six grooves, the ingot making two passes through each groove, except the last. After the first pass through each groove is made, the rolls are screwed down for the return pass, and then released again before the first pass is made through the succeeding groove, and so on.

From the cogging mill the bloom is conveyed to a powerful horizontal shearing machine, where it is cropped and delivered on to a narrow gauge trolley placed on a line below the level of the floor of the mill. One of the small locomotives running on a parallel line of rails is then attached to this trolley and tows it up a short gradient to the mill floor level, and runs it along at great speed to the finishing mill.

This is a reversing mill driven by a pair of engines attached to it direct, and it has a set of roughing and a set of finishing rolls, each 30 inches in diameter. After the partially formed rail has made six passes through the roughing rolls, a series of chains running in grooves below the floor level, and furnished with horns projecting above that level, are brought into use, and transfer the rail laterally to the finishing rolls, through which six more passes are made. On leaving the rolls after each pass the rail is received on rollers, which are allowed to roll through a limited range on slight inclines, so that the rail resting on them has a constant tendency to feed itself down to the rolls. During the latter passes, to economise floor space, the incline receiving the rail is carried up at a considerable angle above the floor so as to allow of traffic passing beneath it. Rails up to 150 feet long or upward are dealt with at Eston with as much ease as shorter lengths, and at the time of their visit, on the 18th of September, the members of the Iron and Steel Institute were able to see rails about 126 feet long rolled off steadily rail after rail, without the slightest hitch of any kind, the time occupied in making the twelve passes through the roughing and finishing rolls being 80 seconds only. This is magnificent work, yet so smoothly did all the operations proceed that it was difficult to realise that the mill was turning out finished rails at the rate of something over a ton per minute. As a matter of fact we believe that over 400 tons of rails have been produced in a ten hours' shift at this mill.

From the finishing mill a series of live rollers convey the rail to the saw, where it is cut into lengths as required. In the form of hot saw used at Eston a massive framing carries a pair of diagonal engines from pulleys, on the raised crankshaft of which belts are led off to pulleys on the saw spindle situated a little above floor level. The whole framing, with engines and saw, is mounted on wheels and moved forward at each cut.

From the saw the rails are run forward on to the rail benches near the middle of the length of the latter, a neat arrangement, worked by a small pair of engines, enabling them to be pushed along the benches to the right or left as may be required. Running over the range of hot rail benches also is a powerful travelling crane, by which bundles of rails can be easily transferred from one part to another as may be necessary to suit the working of the men at the straightening presses.

The hot rail benches are at such a level that the rails can be readily run off from them to the straightening presses, and after being straightened they are passed on to the rail-ending machines and the drilling machines, being finally delivered at the western end of the works. Of the rail finishing plant it is unnecessary to say more here than that it is admirably arranged, and comprises first-class machinery for the several operations to be performed.

So far we have been speaking of the basic side of the works only. On the side devoted to the acid, or ordinary, Bessemer process, the arrangements are very similar. In this case, however, there are four converters of eight tons capacity arranged in the manner to which we made reference in the early part of the present article. The cogging mill on this side, also, serves either of two finishing mills, these being driven by one engine situated between them. Altogether about 5,000 tons of Bessemer steel per week are being turned out at Eston by the two processes.

The blast for the converters is supplied by four vertical blowing engines, three of these having been made by Messrs. Daniel Adamson and Co., while the fourth was constructed by Messrs. Bolckow, Vaughan, and Co. themselves. The Siemens wash-heating furnaces are altegether twelve in number, and are each 25 feet long by 10 feet wide, and provided with four doors; they are both charged and drawn by hydraulic machinery. The steam required in the works is supplied by 42 Lancashire boilers, all made of steel. Of the blast furnaces we need at present only say that there are nineteen, of which ten are fitted with Cowper hot-blast stoves.

We have in the foregoing columns given but an outline description of Messrs. Bolckow, Vaughan, and Co's magnificent works at Eston, and the space at our disposal will not permit of our at present doing more than this. We trust, however, that we have been able to give some idea of the productive power of these works, and of the skill with which that productive power is turned to the best account. In the completeness of their arrangements for the rapid handling of the material in the course of manufacture with the minimum of hand labour, the Cleveland Steel Works are probably unequalled in the world, and the impression received during the inspection will, we are certain, long be remembered by all who took part in the visit to Eston.—*Engineering*.

MELTING METALS BY ELECTRICITY

The electric furnace possesses two great advantages—the temperature which can be produced is only limited by the refractory resistance of the crucible, and the heat is developed in the materials which are to be melted, without first traversing the recipient. Six pounds of forged iron were submitted for twenty minutes to the action of the arc, and the metal was then poured into a mould. It was found to be crystalline and could not be forged. This difficulty may be remedied by adding a little manganese before pouring out; but the reason of this action is not understood. Three quarters of a pound of copper were melted in charcoal dust for an hour, at the end of which time all but three quarters of an ounce had been vaporised. The persons who were present did not perceive any disagreeable effects from the atmosphere, which they were obliged to breathe. Eight pounds of platinum were entirely melted in about a quarter of an hour. A half a pound of powdered tungsten was submitted to the action of the electric arc, in a clay crucible. Very dense fumes escaped, and a cavity of about a half an inch deep formed at the summit. The metal appeared to have been melted to only a very slight depth below the cavity. The unmelted portion was covered with very beautiful crystals, which when examined by a microscope were found to be prismatic, but they were not very uniform. The crystals were evidently formed by the slow cooling of the distilled vapour. Experiments were tried with various other metals, showing that the quantity of any given metal which can be completely melted in an electric furnace, and the time required for the fusion, depend upon the interval between the point of fusion and the point of vaporising, as well as upon the thermal conductibility of the metal. Thus it happens that platinum is melted much more easily than steel, and in a much greater quantity, for the same expenditure of energy.—*L'Electricien.*

RECENT AMERICAN AND FOREIGN PATENTS.

An improved fruit basket in which the cover is made integral with the basket has been patented by Messrs. John W. Rockafellow, of Stockton, and P. T. B. Nevins, of Flemington, N.J. The invention consists in a basket made of splints projecting above the top ring, and adapted to be folded over the top of the basket and to form the cover.

A composition to be applied to roofs and walls for rendering them water and fire proof has been patented by Mr. R. J. Pattison, of New York city. This compound consists of mineral wool, plaster of Paris, oil, liquid glue. all thoroughly mixed together and moulded, after which it is subjected to a heat of from 100° to 160° Fahr.

A novel attachment to the treadle of a sewing machine for aiding and facilitating the operation of the treadle has been patented by Mr. J. A. Robison, of New Washington, Ind. A weight is secured to the treadle above the treadle shaft, and a spring is attached to the weight and frame, both of which serve to aid in depressing the toe of the treadle.

An improvement in chronometers escapements has been patented by Mr. August W. Kientoff, of Dallas, Oregon. In this improvement a lever is provided in connection with the balance wheel so as to be oscillated by it, striking at the same time a second lever, which thereupon unlocks the escapement wheel, this lever being thrown forward immediately by a spring to lock the escapement wheel after it has moved the distance of one tooth. The invention relates also to other details of arrangement and construction

An improved fire escape ladder has been patented by Messrs. Handley B. Kimball and Cornelius S. Barrett of Charlotte, Mich. This ladder consists of two series of bars hinged together and provided at the joints with shoulders, so that the bars will assume a zigzag shape, and the rounds of the ladder will be held away from contact with the side of the house, and descent on the latter thereby very greatly facilitated.

Mr. F. D. Hill, of New York city, has patented an improved burglar alarm which is constructed with a spring clamp connected with a bar jointed to a suspended frame carrying a clock work and gong, and a sliding rod provided with a spring, and having hangers to engage with the escapement anchor, and a catch attached to the suspending bar, whereby the alarm can be readily suspended from a door knob, and will be sprung by the movement of the knob.

A very simple type writing ruler has been patented by Mr. William P. Brown, of Zanesville, O. This truck is provided with hooks which pass over the top of the object to be handled, serving to retain it firmly on the platform of the truck, and also to assist in loading it on the same. A bail is provided also which may be passed over the top of barrels or sacks for holding it in place. The truck further may have two sets of wheels, one back of the other, to facilitate the passage of the trucks over obstructions.

An improved device has recently been patented for ascertaining the flow of electrical current in a circuit and for recording such flow. This device is called an electrical meter, is especially applicable for indicating the current in a system for running incandescent electric lamps. An electro magnet will be employed in conjunction with a recording mechanism, and the number of revolutions made by the motor will be exactly proportioned to the flow of current.

Mr. William M. Brock, of Shamokin, Pa., has patented an improved telephone annunciator, switch board, and transfer table for facilitating connecting two telephone subscribers with each other in such a manner that they do not interfere with the other lines, and are not disturbed themselves. This switch board is divided into a series of annunciator plates, each provided with a like number of plugs, combined with as many wires or rods as there are plugs in each annunciator section, which wires or rods are attacked to the back of the switch in such a manner that the like plugs of each annunciator section can come in contact with the same wire or rod.

A very simple automatic telegraph has recently been patented by Mr. James W. Rogers, of New York. The apparaus consists in a cylinder having a spirally-grooved periphery and a jacket having characters indented therein below the normal plane of the jacket, and two terminals of an electric circuit arranged upon the indented side of the jacket, one of which is made movable and traverses the route of the indentation, being thrown into contact with the other terminal by the non-indented portion or normal plane of the paper, With this apparatus, when a message has once been transmitted on the paper in the form of indentations in the Morse character, the message may be immediately retransmitted without the necessity of removing the paper from the cylinder upon which the message was first recorded.

A car coupling designed for freight cars has been recently patented by Messrs. Thomas R. Morgan, Guy Ruf, and David Davis, of Jackson, O., in the use of which the drawhead has a slot in its lower side, to allow the link (in this case a hook) to drop out of position when cars are to be run together without without coupling. The hook is pivoted and is attached to a bell crank lever by which it may be raised by a rod at the top of the car or by one at the side of the car.

Mr. Nathan M. George, of Danbury, Conn., has patented a device for preventing dust from entering the axle boxes of railroad car and engine axle bearings, and inducing heating and producing wear. The contrivance is composed of a gland of wood and two of leather embracing a packing of felt. Vulcanized fibre or similar material may be used instead of leather; a spring is used to hold the protector in place. This device may be applied to any car and locomotive axle now in use.

Messrs. Henry W. Robie, of Portsmouth, Va., and William H. Lyons, of Berkeley, Va., have invented an apparatus for utilizing the exhaust steam of a steam pump by discharging the steam into the suction side of the pump, to utilize the atmospheric pressure gained by condensing the exhaust steam, and to condense the steam for returning the heat of it, or most of the heat, to the boiler, the said arrangement consisting of a branched exhaust pipe connecting with both ends of a double acting pump, and each branch having a check value to prevent reaction on the steam engine when the compression of the pump takes place.

Mr. Leonidas A. Roberts, of Monticello, Ga., has patented an improved method of securing the ends or joints of rubber belts by re-enforcing the ends at the point of jointure by a flap of leather cut so as to cover the face of the belt, and pass under it on each side. The entire joint is made either by lacing or rivets, or metallic hooks passed through, bent, and clinched. The method demands no skilled labour or engineering calculations.

Messrs. Stephen J. Swayze and John C. Dane, of Sag Harbour, N.Y., have invented an automatic railroad signal intended to provide a signal adapted to be automatically set by the tread or flange of the wheel of the locomotive or car, or any device attached to the engine or car, and to automatically and gradually recede into its inclosure in a given length of time; and this length of time may be governed so that the device may be used as a crossing signal for following trains.

Mr. William P. Badger, of Muscotah, Kas., has patented an improved wind wheel that by means of the reciprocating action of springs and the centrifugal velocity of the wheel, opens and closes automatically the fans or wings of the wheel, to produce a uniform velocity under all circumstances of the force of the wind. A wind chamber is also provided to increase the number of square feet of wind pressure on the wheel.

A machine for forming earthenware vessels has been invented by Mr. Cerbeleon Mertinez Ribon, of Mompos, Bolivar, United States of Colombia, by which the clay is placed in a sectional mould which is secured to the plate of a potter's wheel, or a "jigger," and while being revolved a knife, the edge of which conforms to a vertical section of the interior of the vessel to be made, is inserted by foot or hand power, and the clay is rapidly made to the desired internal shape.

Mr. John D. Waldran, of Memphis, Tenn.' has invented a handy valve grinder, which consists of a contrivance for attachment to the wheel of a globe valve for rotating it backward and forward on its seat by means of a spiral shaft that is operated by means of a reciprocating nut, which is operated by one hand while the guide for the nut and support is held by the other hand, making a simple contrivance by which such valves may be ground quickly and efficiently without being disconnected from the pipes.

Mr. Jackson Taylor, of Newberry, S. C., has patented an improved side spring for carriages by which the springs are resistant to side shocks and internal movements. The springs are also re-enforced by bent U-shaped inner springs that make the central portion of the spring very rigid and yet give elasticity to their ends. The ends of the springs are connected to the carriage by eccentrically pivoted shackle pins, by which the action of the springs under a load is rendered uniform.

Mr. John Henry Nute, of New Glasgow, Nova Scotia, Canada, has invented a machine for serving rope which can be operated by hand, to serve rope or other materials with yarn or twine, the operation being automatic, and the feed regulated to suit the size of the yarn used, so that by steadying the machine with one hand and turning the driving wheel with the other, the spool frame is rotated around the rope to be served, the serving yarn unwinding from the spool and winding around the rope automatically and with accuracy and speed.

Mr Brock Woodruff, of Albert Lea, Minn., has invented an improved process of treating iron in which ordinary wrought iron is first heated to near a welding heat, then rolled in sand, reheated to a somewhat higher temperature than before, again rolled in sand, and again reheated to a welding heat, when it is immediately immersed in water to which has been added common salt in the proportion of one gallon of salt to twelve or fifteen of water, more or less. Iron made by this process may be heated, worked, welded, and otherwise manipulated without destruction of the properties imparted to it in the process named. The iron is very hard and rough, and is far superior to ordinary rolled iron for any ordinary purpose.

Mr. Knight K. Parker, of Circleville, O., has invented a straw stacker for removing the straw from a thrasher and stacking it into a longitudinal rick, making the rick of uniform sides and even height. The stacker is an appendage to the thrashing machine, and is run by the same power; when not in use it may be folded back on the top of the thrashing machine and be carried from place to place.

Mr. Charles T. Mason, Jr., of Sumter, S. C., has invented a cotton harvester which is intended to reduce the expense of the present method of picking cotton by hand. The picking is done by serrated disks of brass or other non-corrodible metal protected by shields of wool from unnecessary wear and abrasion. The disks are suspended on vertical seams and are rotated by level gears on a frame carried by chains and pulleys, so that the pickers rise and lower without disturbing the plants or breaking off the hard wooded portions.

A handy folding table has been patented by Mr. Frederick Gesking, of Grand Rapids, Mich., that can be taken down and put up with little trouble and in little time. When folded it occupies scarcely any more space than the board top alone, and when erected for use it is not only firm, but may be made elegant.

A combination railroad ticket, useful for routes by different roads, and containing in itself the particulars usually sought in railway guides, has been recently patented by Mr. James W. Womeldorf, of Middieport, O. The ticket may be used for more than one person simultaneously, and may be used also for different roads and different stations, the conductors each having their distinctive stubs, and furnishing the basis for a final settlement between the different roads.

Messrs. Lorenzo D. C. Wood, of Newark, N. J., and Thomas B. Dorrell, of Brooklyn, N. Y., have patented a new package fire kindler, which comprises in one package a paper bag, box, or wrapper, which forms a component part of the kindler, kindling wood in detached pieces, and a highly combustible lighter. The paper wrapper and its contents constitute a cheap, convenient, and efficient fire kindler in compact package form, and makes a new article of manufacture, trade, or commerce, each package consisting of sufficient material to light a single fire.

Mr. John Walter, of Nashville, Tenn., has invented a convenient clasp, or coupling, for stove and heat pipes made of thin metal, that obviates the necessity of forming the ends, or joints so that they slip one within the other, or of permanently rivetting sections together. The ends of the sections are beaded or corrugated and an open corrugated band fits around them, the ends being locked by a key of sheet metal, the edges of which are recurved to embrace the end corrugation on the band. By this device sections of pipe may readily be united and taken apart.

Iron Industry of New South Wales.—The existence of extensive deposits of rich iron ores at Wallerawang, Lithgow, Mittagong, Mount Lambie, Berrima, Illawarra, and in various other parts of this colony, has been demonstrated—in many instances in the vicinity of coal and lime in abundance; but owing to the heavy cost of erecting smelting and other works, and the difficulty of securing the necessary skilled labour, very little has yet been done towards developing this important source of wealth. In fact, with the exception of the Fitzroy Works at Mittagong, which have been abandoned for some time past, the only works in the colony are those of the Eskbank Iron Company, at Lithgow Valley, which were originated in 1875. These works consist of furnace, foundry and forge, and rolling mills; the two branches are connected by a horse tramway. Most of the plant, including a 24-ton fly-wheel, was made on the ground. The blast-furnace is capable of producing 100 tons of gray, or 115 tons of white iron per week, Both pig and malleable iron are made, and large quantities of rails for tramways have been rolled. Upon this Company's property are iron ore, coal, fireclay, and moulders' sand. During the year 1881, the Eskbank Iron Company made pig iron to the value of £10,950; bar, angle, and rail iron to the value of £31,086, and castings, &c., to the value of £5,777. During the year, the blast furnace was worked only five months and seventeen days.

PETROLEUM GEOLOGICALLY CONSIDERED.

It is impossible to trace the geological relations of petroleum, so as to show with what rocks it is liable to be associated, where we might find it, and where we may surely find it; it is not limited to any particular formation or age. It is found in almost every possible series of strata, from the lowest Silurian rocks up to the Tertiary and even Post-Tertiary formations. There are certain points in regard to the manner in which it lies in the rocks and is obtained from them that are full of interest. These, perhaps, cannot be traced out to better advantage than by selecting one single region and studying the petroleum as it exists there. The "oil belt," as it is called, from which the main supply of the world is now derived, is a good example. This has many peculiar features belonging only to itself, but it may be assumed to be fairly representative, so far as history and formation are concerned.

The oil belt lies entirely west of the Alleghanies, extending from Canada to Virginia, with a width of 70 miles and upward, but the part from which, practically, the entire product is derived is much smaller, being within the State of Pennsylvania and covering in round numbers 3,200 square miles, though in actual fact only 39½ square miles of even this limited space have really yielded oil in paying quantities. This is, properly, the "oil centre." Throughout its extent the oil wells are gathered in groups, and this grouping is indicative of the relation between the rock oil and the rocks.

An oil well is simply a hole drilled down so that it may serve as a discharge pipe for a fluid that exists at a greater or less depth below the surface of the earth, and is held there as if in a reservoir under pressure. As the drill passes down, the "first sand rock" is struck and passed; nothing is found in it; further down comes the "second sand rock," like the first; further still, the drill strikes the "third sand rock," which is truly the oil-bearing stratum, that is, if the well "strikes oil," for a large proportion of the wells sunk are "dry holes." When the drill breaks through the oil saturated sponge, as the sand rock may be called, the manifestations are sometimes wonderful. The fluid which permeates the rock is, of course, in intercommunication throughout its entire extent, and is always under more or less pressure. The mighty strain that the internal forces exert is graphically illustrated when a "spouting well" is struck.

Now the curious feature of this sand rock is that it is not of uniform thickness, neither does it lie horizontal. Each individual mass or bed is found to be irregularly circular in form, saucer shaped, and thickest in the middle. Within every part of this space oil may be found; outside of it there is none until a similar bed is found. Judging from the quantity of oil which flows and continues to flow from a given well or group of wells, it seems nearly certain that the source is not in the vicinity of the place from whence it is drawn: that these disks of sand rock merely indicate a region which, from its structure, serves as a sort of "chimney," through which the supply from beneath presses upward the pipe serving as a vent. This view of the distance of the source is of great interest and importance. If the supply lies near the surface only, at the level where we tap it, it does seem possible, and in fact probable, that the enormous output of the present day must produce exhaustion, and at no very distant date. But if the true source is in the profound depths of the earth we need have no fear of reaching a limit.

The natnre of petroleum may aid in forming some idea of its origin and the prospects of its continuance. Being a hydrocarbon intimately allied in chemical composition to coal, especially bituminous, it was entirely natural from the first to infer that the two had a similar origin, and this opinion is still maintained by many. As to the origin of coal, there can be no doubt; it was produced by the transformation of vegetable material, through the action of certain agencies of long duration, prominent among which has been heat and pressure. The rock strata in which these vegetable masses were deposited previous to transformation are almost universally concave, and we call them "coal basins," recalling to mind the disks of sandstone in which we find petroleum. The vegetable origin thus indicated necessarily demands for coal an abundant development of life, and no coal has been found in the rocks which are termed azoic.

In this respect it differs from petroleum, though both of them occur in strata of various ages in the later formations. It is very seldom, however, that they are found in juxtaposition. A petroleum spring is not a guide to a coal vein, and though they are so similar in chemical composition no other feature seems manifest which should lead us to infer that petroleum and coal have in any way a common origin, And though coal demonstrates the antecedent occurrence of life, we cannot say the same thing of petroleum. We know that, at the present time, the substances we call organic are composed mainly of carbon, nitrogen, oxygen, and hydrogen. Petroleum is a hydrocarbon, but shows no signs of organic origin. The microscope shows no cells or fibres in it, as in coal. To say the least, it is entirely possible that it is of inorganic origin. The antecedent presence of life is not at all essential to effect a chemical union which will give us a hydrocarbon in either gaseous, liquid, or solid form.

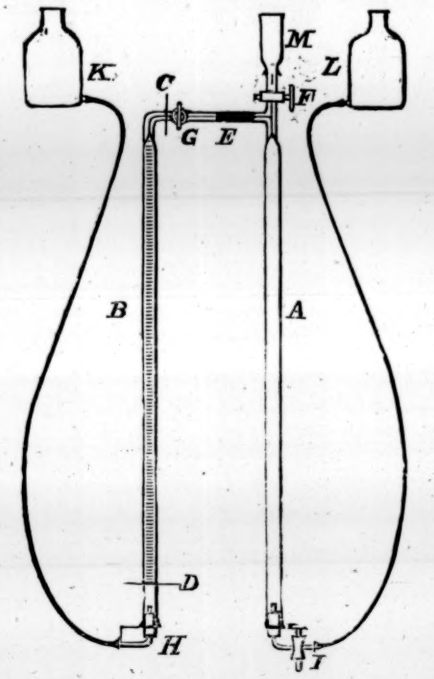
No one probably thinks of demanding an organic origin for carburetted hydrogen. which issues from some of the borings in the oil regions, and there are reasons for believing that the same forces produced the two combinations. Wherever water exists, either as a liquid or as solidified by combination, we find hydrogen in abundance, and in the carbonates we find the supply of carbon, and the structure of the lowest rocks of which we have any knowledge shows plainly that when solid materials began to have place, carbon and hydrogen existed gaseously and separately. There is nothing to hinder their existing thus now; or if not thus uncombined at the present time, what is to hinder their being set at liberty from other unions by the forces of their environment, and thus prepared, to form hydrocarbons when presented to each other? And if thus set free and thus uniting, it is entirely within the range of natural forces that they should form, and perhaps at the same place, the two which we find in juxtaposition—the gas and the liquid. It is true that, according to our ideas of chemistry, we rank these two hydrocarbons in different series; but that proves nothing except our inability to match the workings of the great laboratory in our small establishments. Recent researches have shown us that even we can begin to step from the one series into the other, and that the great internal forces should do it readily and constantly is certainly quite possible. If the supply of petroleum lies only at a small depth, there is little use in searching for a means of using it. But it is altogether probable that we must look deeper for its source, and as it is, perhaps, totally of inorganic origin, we may look to find the supply consistent.

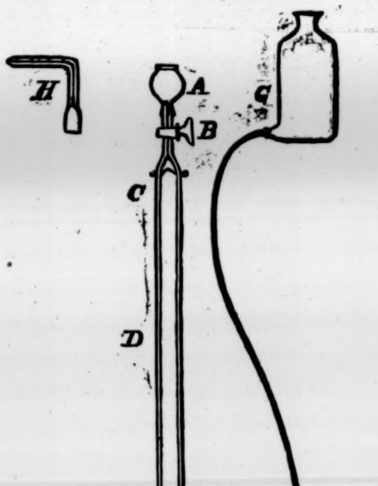
Micro-organisms in the Soil.—R. Koch and P. Miquel found the superficial layers of the soil exceedingly rich in bacilli. Miquel considers that these bacilli play an important part in the decomposition of organic matter and in the formation of assimilable plant food.

AN APPARATUS FOR RAPID GAS ANALYSIS.

By Arthur H. Elliot.

In many manufacturies and metallurgical works it is often of great service to be able to make rapid analyses of the gases resulting from various operations, as these analyses serve to control the operations and indicate the progress of the processes. This is especially true for iron and steel works, where a knowledge of the composition of the gases from a furnace is an index of the character of the changes going on inside the furnace.





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Such rapid analyses are also often needed in gas-works. To meet this requirement of technical works, many methods have been devised and various ingenious forms of apparatus have been constructed. But all the appliances used for this purpose have been based upon the principle of absorbing the various gases in a mixture by liquid reagents. Of the many methods of using liquid reagents that of Orsat is probably the best known, and the one that has been most used. In this apparatus the gas, after being measured, is made to pass into vessels containing the liquid reagents, and so arranged as to expose a large surface, wet with the reagent, to the mixture of gases. If time is of little value, this apparatus works very well, but it is too slow in its action to be desirable for use in technical works. One great objection to the apparatus itself is the number of stop-cocks attached to the various parts of it. These stop-cocks become incrusted with the various reagents and refuse to turn without great trouble; and any force applied to them is apt to cause a fracture, which ruins the apparatus for further work until the damage is repaired.

Instead of passing the gas into a vessel containing the chemical reagents, Raoult put the reagent into a tube containing the gas. In treating a mixture of gases with several reagents, it is necessary to remove one reagent before adding another. This is accomplished by washing out with water in such a manner that the gas is not lost. Raoult performed this treatment of the gases and washing out of reagents in a graduated tube with two stop-cocks, one at each end; one of the stop-cocks was surmounted with a funnel to introduce the fluids. But the whole affair was not easily managed, and the gases were submitted to an unnecessary amount of washing while removing the excess of reagents used.

Wilkinson modified this method, and devised a very simple and useful apparatus, in which the clumsy manipulations of Raoult were overcome by using a tube with one stop-cock above, the lower end of the tube dipping into water in another tube of much larger diameter. By this means the gases could be treated with liquid reagents, introduced through a funnel attached to the stop-cock above; and by introducing or removing water from the outer tube the gas could be measured at atmospheric pressure. To facilitate the removal of liquids from the outer tube, the later has a stop-cock attached belaw. But, as in the apparatus of Raoult, the gases are submitted to an unnecessary amount of washing when water is introduced to remove the reagents. This washing becomes very important in many cases. For example take the case of illuminating gas. We introduce potassic hydrate solution to remove the carbonic acid, then potassic pyrogallate to remove oxygen; and now we must wash out the alkali before adding bromine to absorb the illuminants. To do this, much water is needed, and this large quantity of water will wash out some of the illuminates, often as much as two per cent.

To overcome this difficulty of excessive washing I have devised the apparatus which is the subject of this paper. In this process, the gas is removed from the absorbent liquid and measured in another vessel, without washing.

The apparatus is shown in the figure. The tube A is of about 125 c.c. capacity, whilst B, although of the same length, holds only 100 c.c. from the point D, or zero, to the mark on the capillary tube C, and is carefully graduated in 1-10th c.c. The attachments to these tubes below are seen from the drawing, except that the stop-cock I is three-way and has a delivery through its stem. The bottles K and L hold about a pint each. The tubes A and B are connected above with one another, and also with the cylindrical funnel, M, by a series of capillary tubes about one millimetre in diameter inside. There is a stop-cock at G and another at F, while the funnel M, which holds about 60 c.c., is ground to fit over the end of F above. At F is a piece of rubber tubing uniting the ends of the capillary tubes, which are filed square to make them fit as closely as possible.

Death of M. Plateau.—The death is announced of M. Plateau, emeritus Professor of Physics at the University of Ghent.